



THE EFFECT OF VIDEO-BASED EYE EXERCISE EDUCATION ON REDUCING ASTHENOPIA SYMPTOMS AMONG NURSES: A QUASI-EXPERIMENTAL STUDY

Renanta Adeel Sahasra Hukubun*, F X Bobby Tyas Prastyanto

Sekolah Tinggi Ilmu Kesehatan Mayapada, Jl. Lebak Bulus I, Kav.29, Cilandak, Jakarta Selatan Jakarta, 12440,

Indonesia

*renantaadel@gmail.com

ABSTRACT

The use of computers and digital screens in Electronic Health Record (EHR)-based nursing documentation may increase nurses visual workload and the risk of asthenopia, including dry eyes, blurred vision, difficulty focusing, and headaches. This condition requires attention as part of promotive and preventive efforts in Hospital Occupational Health and Safety (K3RS). Eye exercises are a non-pharmacological intervention that can be performed independently to reduce these symptoms. This study aimed to analyze the effect of video-based eye exercise education on reducing asthenopia symptoms among nurses. This study used a quasi-experimental design with a pre-test and post-test control group approach. A total of 36 nurses were selected using purposive sampling, consisting of 18 respondents in the intervention group and 18 respondents in the control group. The study used the Asthenopia Survey Questionnaire-11 (ASQ-11) to assess asthenopia symptoms among nurses. The ASQ-11 is a valid and reliable instrument, with a Cronbach's alpha of 0.89, split-half reliability of 0.82, and test-retest reliability of 0.90 ($p < 0.001$). The intervention group received video-based eye exercise education for seven days. Data were analyzed using the Paired Sample T-Test, Welch Test, and Cohen's Effect Size. The mean asthenopia score in the intervention group decreased from 25.67 to 13.17 after the intervention. The test results showed a significant difference before and after the intervention ($p < 0.000$), with a Cohen's d value of 4.642. Video-based eye exercise education was effective in reducing asthenopia symptoms among nurses.

Keywords: asthenopia; eye exercises; hospital occupational health and safety; nurses

How to cite (in APA style)

Hukubun, R. A. S., & Prastyanto, F. X. B. T. (2026). The Effect of Video-Based Eye Exercise Education on Reducing Asthenopia Symptoms among Nurses: A Quasi-Experimental Study. *Indonesian Journal of Global Health Research*, 8(5), 427–436. <https://doi.org/10.37287/ijghr.v8i5.2240>.

INTRODUCTION

Hospital Occupational Health and Safety (K3RS) is an effort to ensure and protect the safety and health of hospital workers through the prevention of occupational accidents and work-related diseases. The implementation of K3RS is important because healthcare workers are at risk of exposure to various hazards in the work environment (Ministry of Health, 2022; WHO, 2022). Nurses represent the largest group of healthcare workers and play an essential role in hospital services. Their extensive responsibilities make nurses vulnerable to health problems related to workload, work environment, and complex service demands. Along with the development of information technology, healthcare documentation systems have shifted from paper-based records to electronic documentation (Jedwab et al., 2022). Electronic Health Records (EHR) are digital systems used to record, store, manage, and access patients health information (Dubale et al., 2023).

Nurses are among the primary users of EHR system because various nursing activities, such as documenting nursing care, recording vital signs, entering patient data, and monitoring patient conditions, are performed using computers or monitors. The implementation EHR has become part of the digital transformation of healthcare services in Indonesia following the issuance of Ministry of Health Regulation Number 24 of 2022 concerning Medical Records, which requires all healthcare facilities to implement Electronic Health Records (Ministry of Health, 2022). Previous research has stated that nurses may spend more than half of their working time entering and

retrieving data in electronic medical record systems (Farajallah, 2026). The high intensity of prolonged digital screen exposure makes nurses vulnerable to eye fatigue or asthenopia. Asthenopia is a group of ocular discomfort symptoms that may occur due to prolonged near-vision activities or continuous exposure to digital screens (Lema & Anbesu, 2022).

Globally, the prevalence of asthenopia has been reported to be relatively high from 75% to 90%, affecting approximately 285 million people or 4.24% of the world's population (Elzha et al., 2024). In Southeast Asia, a study among students in Thailand reported an eye fatigue prevalence of 80.40% (Sengsoon et al., 2026). In Indonesia, the prevalence of asthenopia among workers has been reported at 83.7% (Pertiwi et al., 2023). According to the American Optometric Association, prolonged computer screen use can increase visual workload and lead to eye fatigue complaints. Symptoms of asthenopia include eye fatigue, dry eyes, heavy eyes, blurred vision, headaches, and difficulty focusing after prolonged computer use. Several risk factors contribute to the occurrence of asthenopia, including duration of computer use, screen time, length of employment, and refractive errors (Nadya Salsabila et al., 2024).

Based on interviews with 10 nurses at Hospital X, it was found that nurses spent more than four hours per day in front of a computer to perform nursing documentation and enter patient data through the Electronic Health Record system. This finding is consistent with data from the National Institute for Occupational Safety and Health in the United States, which states that 90% of workers who spend three hours or more per day in front of a computer may experience various eye complaints (Unari & Surjani, 2022). Refractive errors, such as myopia, hypermetropia, and astigmatism, may also worsen symptoms of asthenopia (Rachmanee & Tultrairatana, 2025). Asthenopia among nurses can affect occupational health and the quality of healthcare services because it may reduce concentration and productivity. In nursing practice, this condition may also increase the risk of errors in electronic documentation and nursing care delivery, thereby potentially affecting patient safety (Lema & Anbesu, 2022).

The high risk of asthenopia has not been accompanied by adequate implementation of eye health programs. Therefore, promotive and preventive efforts are needed to reduce asthenopia complaints. One non-pharmacological intervention that can be applied is eye exercise. Eye exercise is a form of training aimed at relaxing the eye muscles, improving visual accommodation, and reducing eye strain caused by prolonged digital screen exposure (Zhuang & Sitepu, 2023). Based on the literature, non-pharmacological eye exercise interventions have been shown to reduce eye fatigue complaints among workers. A study by Maisal et al., (2020) showed that eye exercises were able to reduce eye fatigue complaints among barbers. In addition, Hermolinda (2024) found that regular eye exercises significantly reduced eye fatigue levels compared with before the intervention. Based on evidence-based practice, the regular implementation of eye exercises has been shown to be effective compared with other interventions in reducing symptoms of asthenopia (Meliani et al., 2023).

The selection of this topic among nurses was based on the high intensity of computer use in nursing services supported by Electronic Health Records, while attention to the eye health of healthcare workers in hospitals remains limited. In addition, studies discussing asthenopia among nurses are still limited. Video-based eye exercise education was selected because it is a non-pharmacological method that is easy to implement, does not require special equipment, and can be performed independently by nurses during work. Based on this urgency, video-based eye exercise education may serve as a practical, effective, and feasible intervention that can be applied during nursing activities. Therefore, this study is important to provide scientific evidence regarding the effect of video-based eye exercise education on reducing asthenopia complaints among nurses as part of preventive K3RS efforts in hospitals.

METHOD

This study used a quasi-experimental design with a pre-test and post-test control group approach. The population consisted of all nurses working at Hospital X, with a total of 184 nurses. The sample size was determined using Federer's formula, resulting in 36 respondents who were divided into two groups: 18 respondents in the intervention group and 18 respondents in the control group. The sampling technique used was purposive sampling. The inclusion criteria were nurses who experienced asthenopia complaints. The exclusion criteria were nurses who were on leave or inactive during the study period, as well as nurses who were undergoing special eye treatment. Asthenopia complaints were measured using the Asthenopia Survey Questionnaire-11 (ASQ-11), which consists of 11 indicators of eye-related complaints. Previous validation studies have demonstrated that the ASQ-11 possesses strong psychometric properties, including high internal consistency (Cronbach's $\alpha = 0.89$), split-half reliability (0.82), and test-retest reliability ($r = 0.90$, $p < 0.001$). Furthermore, the instrument has shown adequate validity, sensitivity, and specificity, supporting its application as a reliable screening tool for asthenopia (Lin et al., 2023). The intervention group received video-based eye exercise education for seven days, with a frequency of twice a day for 10–15 minutes per session, adjusted to the nurses' shift schedules.

During the intervention period, respondent compliance was monitored to assess adherence to the implementation of eye exercises. Data were collected through demographic data forms and the ASQ-11 questionnaire before and after the intervention. The collected data were then processed through editing, coding, data entry, and tabulation. Data analysis was performed using SPSS. Respondents' characteristics were analyzed descriptively using frequency distribution. The normality test was conducted using the Shapiro-Wilk test, while variance homogeneity was tested using Levene's test. Differences in asthenopia scores before and after the intervention were analyzed using the Paired Sample T-Test. Differences in scores between the intervention and control groups were analyzed using Welch's test when the data variance was not homogeneous. The magnitude of the intervention effect was analyzed and categorized using Cohen's Effect Size.

RESULT

Table 1.
Respondent Characteristics (n=36)

Respondent Characteristics	Category	f	%
Age	20–25 years	9	25.0
	26–35 years	16	44.4
	36–45 years	9	25.0
	46–55 years	2	5.6
Gender	Male	11	30.6
	Female	25	69.4
Length of employment	Less than 1 year	6	16.7
	1–5 years	14	38.9
	More than 5 years	16	44.4
Work unit	Inpatient ward	27	75.0
	Hemodialysis unit	3	8.3
	Perinatology/NICU	2	5.6
	Outpatient clinic	2	5.6
	Operating room	1	2.8
Working hours per shift	ICU	1	2.8
	Less than 8 hours	7	19.4
	8–12 hours	29	80.6
	More than 12 hours	0	0.0
Duration of digital screen exposure	Less than 2 hours	3	8.3
	2–4 hours	12	33.3
	More than 4 hours	21	58.3
History of visual impairment	None/normal vision	7	19.4
	Myopia/nearsightedness	20	55.6
	Astigmatism	4	11.1
	Combined visual impairment	5	13.9

Table 1, most respondents were in the age group of 26–35 years, with 16 respondents (44.4%), and the majority were female, with 25 respondents (69.4%). In terms of length of employment, most respondents had worked for more than five years, with 16 respondents (44.4%). The majority of respondents worked in the inpatient ward, with 27 respondents (75.0%), and had working hours of 8–12 hours per shift, with 29 respondents (80.6%). In addition, most respondents had more than four hours of digital screen exposure per day, with 21 respondents (58.3%), and had a history of myopia or nearsightedness, with 20 respondents (55.6%). Compliance monitoring was conducted among 18 respondents in the intervention group during the seven-day implementation of eye exercises. The results of respondent compliance monitoring are presented in Table 2.

Table 2.

Compliance with Eye Exercise Implementation in the Intervention Group

Compliance Parameter	Category	f	%
Completeness of movements	9 of 9 movements	9	50.0
	8 of 9 movements	4	22.2
	7 of 9 movements	5	27.8
Duration of implementation	Appropriate, 10–15 minutes	18	100.0
	Not appropriate	0	0.0
Frequency of implementation	Once/day	4	22.2
	Twice/day	10	55.6
	Three times/day	4	22.2
Total compliance category	Compliant	18	100.0
	Non-compliant	0	0.0

Table 2, 9 respondents (50.0%) were able to perform the complete series of eye exercises. In terms of duration, all respondents (100.0%) performed the eye exercises according to the predetermined time, which was 10–15 minutes per session. Based on the frequency of implementation, most respondents performed the eye exercises twice a day, with 10 respondents (55.6%). Overall, all respondents in the intervention group were categorized as compliant, with a total of 18 respondents (100.0%). Before conducting statistical analysis, the asthenopia complaint scores were first tested for normality and homogeneity. The normality test results showed that all data were normally distributed; therefore, the analysis could be continued using parametric tests. However, the homogeneity test results indicated that the data variance was not homogeneous, so the analysis of differences between groups referred to Welch's test. The Paired Sample T-Test was used to determine the difference in asthenopia complaint scores before and after the provision of video-based eye exercise education in the intervention group. The test results are presented in Table 3

Table 3.

Paired Sample T-Test Results of in the Intervention Group

Variable	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
<i>Pre-test Intervensi</i>	18	25,67	3,565			
<i>Post-test Intervensi</i>	18	13,17	1,339	13,010	17	0,000

The test results showed that the mean asthenopia complaint score before the intervention was 25.67, while after the intervention the mean score decreased to 13.17. Based on the results of the Paired Sample T-Test, a p-value of < 0.000 was obtained. This value indicates a significant difference between the pre-test and post-test scores in the intervention group. The decrease in the mean score after the provision of video-based eye exercise education indicates that the intervention had an effect on reducing asthenopia complaints among nurses. The analysis of mean differences between the intervention group and the control group was further conducted using Welch's test. The test results are presented in Table 4.

Table 4.

Welch Test Results of in the Intervention Group

Variable	Statistic	df1	df2	Sig.
Skor <i>Asthenopia</i>	288,805	1	23,892	0,000

Based on the results of Welch's test, a p-value of < 0.000 was obtained, indicating a significant difference in the mean asthenopia scores between the intervention group and the control group. Before interpreting the magnitude of the intervention effect, the effect size was analyzed using

Cohen's criteria to determine the strength of the intervention effect on the study outcome. After the statistical test showed a significant result, the analysis was continued by examining the magnitude of the intervention effect using Cohen's Effect Size. The results of the analysis are presented in Table 6.

Tabel 6.
Cohen's Effect Size Results of in the Intervention Group

Variable	Effect size	Standardizer	Point estimate
Pre-Test–Post-Test Intervention Group	Cohen's d	2,693	4,642

Based on Cohen's Effect Size analysis, the Cohen's d value was 4.642, which is classified as a very large effect because it falls within the range of $ES \geq 1.30$. This finding indicates that video-based eye exercise education had a very strong effect on reducing asthenopia complaints among nurses.

DISCUSSION

Based on the study results, most respondents were in the age group of 26–35 years, with 16 respondents (44.4%). This age group is considered productive adulthood, which is generally associated with high work activity. Theoretically, the risk of asthenopia increases with age due to decreased lens elasticity and reduced accommodation ability. However, asthenopia may also occur in productive-age individuals when accompanied by high visual workload, such as the use of electronic health records, nursing documentation, and prolonged digital screen exposure during work (Pabala et al., 2021; Nadya Salsabila et al., 2024). Based on gender, most respondents were female, with 25 respondents (69.4%). Women are more at risk of experiencing asthenopia complaints due to hormonal factors that may affect tear film stability, making the eyes more prone to dryness, irritation, and discomfort. This finding is in line with Sengo (2023), who stated that women have a higher risk of eye fatigue than men. Based on length of employment, most respondents had worked for more than five years, with 16 respondents (44.4%), and most worked in inpatient wards, with 27 respondents (75.0%). Longer work duration and inpatient ward duties may increase repeated visual exposure because nurses continuously monitor patients, record nursing actions, report patient conditions, and document nursing care. These conditions may contribute to an increased risk of asthenopia (Artime-Ríos et al., 2022; Aulia et al., 2023).

Based on working hours per shift, most respondents worked 8–12 hours per shift, with 29 respondents (80.6%), and had more than four hours of screen time per day, with 21 respondents (58.3%). Long working hours and prolonged screen exposure can increase visual workload because the eyes continuously accommodate when viewing screens at close range. Digital screen exposure of more than four hours is also one of the risk factors for asthenopia (Song et al., 2026; Tou et al., 2021). Based on history of visual impairment, most respondents had a history of myopia, with 20 respondents (55.6%). Refractive errors may cause blurred vision, requiring the eyes to work harder to maintain focus, especially during near-vision activities. This condition may worsen asthenopia complaints, particularly among nurses who frequently use computers and electronic health records during work (Kuswanto et al., 2021).

Compliance with Eye Exercise Implementation

The monitoring results showed that all respondents in the intervention group were categorized as compliant, with 18 respondents (100.0%). Compliance was assessed based on movement completeness, duration suitability, and frequency of eye exercise implementation during the intervention period. This monitoring was conducted to ensure that video-based eye exercises were performed according to the procedure. The implementation of eye exercises referred to ocular yoga movements, such as rotating the eyeballs, looking in various directions, blinking, near-far focus exercises, following finger movements, forming a figure-eight movement, and eye palming. These movements aim to train and relax the eye muscles, thereby helping to reduce strain caused by continuous visual activity (Rizanti, 2021). Although respondents were generally compliant, several respondents occasionally missed certain movements, such as forming a figure-eight movement,

following finger movements, and holding eye gaze for three seconds, because these movements required adequate concentration and visual coordination. In terms of duration, all respondents performed eye exercises according to the predetermined time, which was 10–15 minutes. In terms of frequency, most respondents performed eye exercises twice a day. This is in line with studies by Aryani et al., (2024), Rusdiatin et al., (2025), and Zalfa et al., (2024), which showed that eye exercises can be performed within approximately 10–15 minutes and remain effective when applied during work activities. The use of video also supported respondent compliance because audiovisual media involve both the senses of sight and hearing, making information easier to understand. Videos help respondents observe movement demonstrations directly and replay steps that are not yet understood, thereby improving skills, independence, and compliance in performing eye exercises (Sayuti et al., 2022; Sianipar et al., 2023). Therefore, respondent compliance served as one of the supporting factors for the success of video-based eye exercise education in reducing asthenopia complaints among nurses.

The Effect of Video-Based Eye Exercise Education on Reducing Asthenopia Complaints

Based on the study results, the mean asthenopia complaint score in the intervention group before receiving video-based eye exercise education was 25.67, while after the intervention it decreased to 13.17. This finding indicates a reduction in the mean asthenopia complaint score after the respondents performed the eye exercise intervention. Theoretically, asthenopia may cause various complaints, such as red eyes, eye irritation, itching, watery eyes, blurred vision, headaches, drowsiness, and tension in the neck and shoulders. These complaints may interfere with work comfort, reduce concentration, and affect productivity during work (Lin et al., 2023). The decrease in asthenopia complaints after the intervention may occur because eye exercises help relax the eye muscles, reduce visual strain, and improve comfort during activities that require visual focus. In addition, eye exercise is a non-pharmacological intervention that is easy to perform, does not require special equipment, and is safe to practice regularly (Asmarani & Sucipto, 2020; Rizanti, 2021).

The Paired Sample T-Test results showed a p-value of < 0.001 . This value is smaller than 0.05, indicating a significant difference between the pre-test and post-test scores in the intervention group. This finding is consistent with Tarnoto & Yasmin (2023), who showed that eye exercise had an effect on reducing asthenopia. Their study used a one-group pre-test and post-test design involving 43 respondents and obtained a p-value of 0.000, indicating a significant difference before and after eye exercise intervention. The similarity of these findings strengthens the evidence that eye exercise can be a simple and effective intervention to reduce asthenopia complaints.

The Welch test results showed a p-value of < 0.000 . This value is smaller than 0.05, indicating a significant difference in the mean asthenopia scores between the intervention group and the control group. This means that nurses who received video-based eye exercise education experienced a greater reduction in asthenopia complaints compared with those who did not receive the intervention. Eye exercises can help improve accommodation ability and relax the eye muscles. When performed regularly, these exercises may reduce eye muscle stiffness caused by prolonged visual activity (Nau et al., 2023; Harahap et al., 2023). This study is also in line with Rusdiatin, Maulana & Nurrohmah (2025), who showed that eye exercise therapy conducted for seven days with a duration of 10 minutes was able to reduce asthenopia symptoms in the intervention group.

After the Paired Sample T-Test showed a significant difference between pre-test and post-test scores in the intervention group, the analysis was continued by examining the magnitude of the intervention effect using Cohen's d effect size. The result showed a Cohen's d value of 4.642. This value is categorized as very large because it exceeds the threshold for the very large interpretation category. This finding is in line with Habiba & Jaya (2025), who examined the effectiveness of a mobile eye-exercise application in reducing asthenopia among office workers. Their study showed a

significant reduction in asthenopia scores in the intervention group with a p-value of < 0.000 . In addition, the effect size results were categorized as very large, with $d = 1.57$ for within-group analysis and $d = 1.74$ for between-group analysis. Therefore, video-based eye exercise education was proven to have an effect on reducing asthenopia complaints among nurses. This was demonstrated by the decrease in asthenopia scores in the intervention group, the significant difference between the intervention and control groups, and the effect size value indicating a very large intervention effect.

CONCLUSION

Based on the study results, video-based eye exercise education was proven to have an effect on reducing asthenopia complaints among nurses. The results of the Paired Sample T-Test and Welch's test showed a p-value=0.000, indicating a significant difference before and after the intervention, as well as between the intervention group and the control group. All respondents in the intervention group were also categorized as compliant, indicating that the intervention was implemented properly during the study period. The effect size result, which was categorized as very large, showed that video-based eye exercise education had a strong effect on reducing asthenopia complaints. Therefore, this intervention can be used as one of the promotive and preventive efforts to support Hospital Occupational Health and Safety (K3RS), as it is easy to perform, does not require special equipment, and can be implemented independently by nurses and other healthcare workers.

REFERENCES

- American Optometric Association. (2017). Computer vision syndrome. <http://www.aoa.org/patients-and-public/caring-for-your-vision/protecting-your-vision/computer-vision-syndrome>
- Artime-Ríos, E., Suárez-Sánchez, A., Sánchez-Lasheras, F., & Seguí-Crespo, M. (2022). Computer vision syndrome in healthcare workers using video display terminals: An exploration of the risk factors. *Journal of Advanced Nursing*, 78(7), 2095–2110. <https://doi.org/10.1111/jan.15140>
- Aryani, A., Widiyono, & Ariastuti, R. (2024). Kombinasi senam mata dan pemberian terapi komplementer herbal kencur terhadap asthenopia pada mahasiswa keperawatan. *Jurnal Wacana Kesehatan*, 9(1), 1–8. <https://doi.org/10.52822/jwk.v9i1.647>
- Aulia, T., Sitohang, J. M., Sihalohe, L. B., Silaen, A. C., & Nurhidayah, R. E. (2023). Peran perawat dalam pemberian asuhan keperawatan yang bermutu untuk meningkatkan kepuasan pasien. *Jurnal Rekam Medis dan Manajemen Informasi Kesehatan*, 3(1).
- Dubale, A. T., Mengestie, N. D., Tilahun, B., & Walle, A. D. (2023). User satisfaction of using electronic medical record system and its associated factors among healthcare professionals in Ethiopia: A cross-sectional study. *BioMed Research International*, 2023, Article 4148211. <https://doi.org/10.1155/2023/4148211>
- Elzha, A., Welkis, Y., Berek, N. C., & Setyobudi, A. (2024). The occurrence of asthenopia among online gamers in Kupang City, East Nusa Tenggara. *Publication Issue*, 9, 77–85.
- Farajalla, F. (2026). Nurses' work satisfaction with electronic medical record use and associated facilitators and barriers in Palestine. *SAGE Open Nursing*, 12, 23779608261418586. <https://doi.org/10.1177/23779608261418586>
- Habiba, P. G. S., & Jaya, A. (2025). Mobile eye-exercise MataSehatKu application to reduce asthenopia in office workers: A quasi-experimental study. *MEDISAINS: Jurnal Ilmiah Ilmu-Ilmu Kesehatan*, 23(3), 171–175. <https://doi.org/10.30595/medisains.v23i3.27494>
- Harahap, L. A., Hasanah, O., & Woferst, R. (2023). Perbedaan efektivitas senam mata dan akupresur mata terhadap penurunan gejala computer vision syndrome (CVS) pada remaja. *Health Care: Jurnal Kesehatan*, 12(1), 68–77.

- Jedwab, R. M., Manias, E., Hutchinson, A. M., Dobroff, N., & Redley, B. (2022). Nurses' experiences after implementation of an organization-wide electronic medical record: Qualitative descriptive study. *JMIR Nursing*, 5(1), e39596. <https://doi.org/10.2196/39596>
- Juandi, D., Kusumah, Y. S., Tamur, M., Perbowo, K. S., Siagian, M. D., Sulastri, R., & Negara, H. R. P. (2021). The effectiveness of dynamic geometry software applications in learning mathematics: A meta-analysis study. *International Journal of Interactive Mobile Technologies*, 15(2), 18–37. <https://doi.org/10.3991/ijim.v15i02.18853>
- Kaur, K., Gurnani, B., Nayak, S., Deori, N., Kaur, S., Jethani, J., Singh, D., Agarkar, S., Hussaindeen, J. R., Sukhija, J., & Mishra, D. (2022). Digital eye strain: A comprehensive review. *Ophthalmology and Therapy*, 11, 1655–1680. <https://doi.org/10.1007/s40123-022-00540-9>
- Kementerian Kesehatan Republik Indonesia. (2016). Peraturan Menteri Kesehatan Republik Indonesia Nomor 66 Tahun 2016 tentang keselamatan dan kesehatan kerja rumah sakit. Kementerian Kesehatan Republik Indonesia.
- Kementerian Kesehatan Republik Indonesia. (2022). Peraturan Menteri Kesehatan Republik Indonesia Nomor 24 Tahun 2022 tentang rekam medis. Kementerian Kesehatan Republik Indonesia. <https://peraturan.bpk.go.id/Details/245544/permenkes-no-24-tahun-2022>
- Kuswanto, V., Kurniawan, F., & Amita, A. S. D. (2021). Association between refractive error types and asthenopia in primary school students. *Majalah Kedokteran Bandung*, 53(3), 126–131. <https://doi.org/10.15395/mkb.v53n3.2236>
- Lema, A. K., & Anbesu, E. W. (2022). Computer vision syndrome and its determinants: A systematic review and meta-analysis. *SAGE Open Medicine*, 10, 20503121221142402. <https://doi.org/10.1177/20503121221142402>
- Lin, N., Zhu, Y., Wu, X., Yang, M., Lu, F., & Deng, R. (2023). Prevalence and determinants of asthenopia among ophthalmologists in China: A national cross-sectional survey. *Frontiers in Public Health*, 11, 1290811. <https://doi.org/10.3389/fpubh.2023.1290811>
- Maisal, F. M., Ruliati, L. P., Berek, N. C., Roga, A. U., & Ratu, J. M. (2020). Efektivitas senam mata untuk mengurangi tingkat kelelahan mata pada pekerja rambut palsu. *Jurnal Ergonomi Indonesia (The Indonesian Journal of Ergonomics)*, 6(1), 9. <https://doi.org/10.24843/jei.2020.v06.i01.p02>
- Meliani, Y. H. O., Sinaga, F. D., Maharina, F. D., Setyarini, E. A., & Listianingsih, L. T. (2023). Perbedaan senam otot mata dengan teknik 20-20-20 rule terhadap computer vision syndrome pada mahasiswa STIKES Santo Borromeus. *Jurnal Kesehatan*, 11(1), 206–217.
- Nadya Salsabila, O., Nugroho, H., & Andriyanti, A. A. (2024). Faktor-faktor penyebab keluhan subyektif kelelahan mata (asthenopia) pada petugas rekam medis di Rumah Sakit Condongcatur Sleman. *Publication Issue*, 15(1), 1–7.
- National Eye Institute. (2025). Refractive errors. National Institutes of Health.
- Nau, S. V., Sagita, S., Setiawan, I. M. B., & Artawan, I. M. (2023). Senam mata menurunkan computer vision syndrome (CVS). *Cendana Medical Journal*, 207–210.
- Nurrohmah, N., Asmarani, F. L., & Sucipto, A. (2020). Kombinasi senam mata dan pemberian kencur dalam menurunkan tingkat nyeri mata lelah pada penjahit. *Interest: Jurnal Ilmu Kesehatan*, 9(2), 173–182.
- Pabala, J. L., Roga, A. U., & Setyobudi, A. (2021). Hubungan usia, lama kerja, dan tingkat pencahayaan dengan kelelahan mata (asthenopia) pada penjahit di Kelurahan Kuanino Kota Kupang. *Media Kesehatan Masyarakat*, 3(2), 215–225. <https://doi.org/10.35508/mkm.v3i2.3258>
- Pertiwi, W. E., Nasiatin, T., & Permatasari, I. (2023). Determinan kelelahan mata pada pekerja pengguna komputer. *Jurnal Ilmiah Kesehatan*, 22(1), 45–56.

- Rachmanee, P., & Tultrairatana, S. (2025). Prevalence and associated factors of computer vision syndromes in healthcare personnel in Nopparat Rajathanee Hospital. *Journal of The Royal Thai Army Nurses*, 26(1), 211–219.
- Rizanti, A. P. (2021). Yoga ocular exercises to maintain eye health during work and distance learning in the new normal era. *Jurnal Berita Ilmu Keperawatan*, 14(1), 1–9. <https://doi.org/10.23917/bik.v14i1.13363>
- Rusdiatin, I. E., Maulana, D., & Nurrohmah, H. (2025). Effect of eye exercise therapy on asthenopia symptoms among Islamic boarding school students in Cirebon: A quasi-experimental study. *Buletin Penelitian Kesehatan*, 53(1), 21–28. <https://doi.org/10.33860/bpk.v53i1.4014>
- Sayuti, S., Rini, W. N. E., & Suraya, I. (2022). Efektivitas edukasi kesehatan melalui media video terhadap tingkat pengetahuan siswa dalam penerapan protokol kesehatan. *Jurnal Kesmas Jambi*, 6(2).
- Sengsoon, P., Nuthong, N., Intaruk, R., Theppitak, C., Yeampattanaporn, O., Jianramas, N., Semphuet, T., & Yasmin, S. F. (2026). Digital eye strain from digital device usage among university students: Prevalence and associated factors. *International Journal of Environmental Research and Public Health*, 23(5), 542. <https://doi.org/10.3390/ijerph23050542>
- Sengo, D. B., Pica, A. D. B., Dos Santos, I. I. D. B., Mate, L. M., Mazuze, A. N., Caballero, P., & López-Izquierdo, I. (2023). Computer vision syndrome and associated factors in university students and teachers in Nampula, Mozambique. *BMC Ophthalmology*, 23, 508. <https://doi.org/10.1186/s12886-023-03253-0>
- Sianipar, S. S. (2023). Effect of health education using media audio visual on knowledge about anemia in adolescent women in high school. *Jambura Journal of Health Sciences and Research*.
- Song, F., Liu, Y., Zhao, Z., Shang, X., Wang, Y., Lai, M., He, M., & Chen, Y. (2026). Clinical manifestations, prevalence, and risk factors of asthenopia: A systematic review and meta-analysis. *Journal of Global Health*, 16, 04053. <https://doi.org/10.7189/jogh.16.04053>
- Tarnoto, K. W., & Yasmin, Y. (2023). Penurunan asthenopia dengan penerapan intervensi yogic eye exercise. *Jurnal Keperawatan Dirgahayu*, 5(1), 1–8. <https://doi.org/10.52841/jkd.v5i1.328>
- Tou, F., Sumarni, & Putri, I. R. R. (2021). Pengaruh stres kerja terhadap kinerja perawat di ruangan hemodialisa RSUD Panembahan Senopati Bantul di masa pandemi Covid-19 tahun 2021. *Indonesian Journal of Hospital Administration*, 4(2), 63–68.
- Unari, U., & Surjani, I. (2022). Profil pasien Klinik Mata KMU Gresik selama pandemi Covid-19 periode Maret 2020–Desember 2021. *Nusantara: Jurnal Ilmu Pengetahuan Sosial*, 9(1), 123–133.
- Waang, I. H., Ruliati, L. P., Ratu, J. M., Roga, A. U., & Berek, N. C. (2024). Efektifitas eye exercise terhadap penurunan tingkat asthenopia pada pegawai Inspektorat Daerah Provinsi NTT. *SEHATMAS: Jurnal Ilmiah Kesehatan Masyarakat*, 3(3), 609–618. <https://doi.org/10.55123/sehatmas.v3i3.3816>
- World Health Organization. (2022, November 7). Occupational health: Health workers. World Health Organization.
- World Health Organization. (2024). Occupational health and safety for health workers. World Health Organization. <https://www.who.int>
- Yulnefia, Dasrinal, Remaldi, G., & Hidayati, M. (2024). Hubungan durasi penggunaan smartphone dan computer dengan kelelahan mata pada mahasiswa Program Studi Pendidikan Dokter Fakultas Kedokteran dan Ilmu Kesehatan Universitas Abdurrah. Gymnasia: Jurnal Pendidikan Jasmani Olahraga dan Kesehatan, 3(1), 80–89. <http://jurnal.anfa.co.id/index.php/PJKR>

- Zalfa, A., Widjanarti, M. P., & Chahyadhi, B. (2024). Pengaruh video senam mata terhadap kelelahan mata pekerja area Sub Assy PT. Gemala Kempa Daya. *Jambura Journal of Health Sciences and Research*, 6(4), 459–467. <https://doi.org/10.35971/jjhsr.v6i4.26674>
- Zhuang, A., & Sitepu, B. R. E. (2023). Effect of eye exercises on computer vision syndrome among medical students of Universitas Sumatera Utara, Indonesia. *International Journal of Integrated Health Sciences*, 11(1). <https://doi.org/10.15850/ijihs.v11n1.3136>.